Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations	)	ET Docket No. 00-11

To the Commission:

COMMENTS OF ECHOSTAR SATELLITE CORPORATION

David K. Moskowitz
Senior Vice President
and General Counsel
EchoStar Satellite Corporation
5701 South Santa Fe
Littleton, CO 80120
303/723-1000

Philip L. Malet
Pantelis Michalopoulos
James M. Talens
Steptoe & Johnson LLP
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036
202/429-3000

Counsel for EchoStar Satellite Corporation

Dated: February 22, 2000

SUMMARY

EchoStar Satellite Corporation ("EchoStar") hereby submits its comments to the Notice of Proposed Rulemaking ("NPRM") in the above-captioned proceeding,[1] where the Commission has set out to implement the Satellite Home Viewer Improvement Act's requirement that it establish a point-to-point predictive model for reliably and presumptively determining the ability of individual locations to receive an over-the-air television broadcast signal.[2]

Congress has instructed the Commission to rely on the Individual Location Longley-Rice ("ILLR") model that the Commission developed in Docket No. 98-201,[3] and also to ensure that the model take into account terrain, building structures, and other land cover variations.[4] The NPRM contains specific proposals intended to account for some such

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[1] *In the Matter of Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations*, ET Docket No. 00-11, Notice of Proposed Rulemaking, FCC 00-17 (rel. January 20, 2000).

[2] *See Satellite Home Viewer Improvement Act of 1999* ("SHVIA"), *Title 1 of the Intellectual Property and Communications Omnibus Reform Act of 1999*, P.L. 106-113, 113 Stat. 1501, Appendix I (1999) (relating to copyright licensing and carriage of broadcast signals by satellite carriers). The Commission commenced this proceeding in response to the requirements set forth in SHVIA. The signal intensity for determining eligibility is the Grade B standard set forth in 47 C.F.R. §73.683(a).

[3] *See Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act Part 73 Definition and Measurement of Signals of Grade B Intensity*, Report and Order ("SHVA Report and Order"), CS Docket No. 98-201, 14 FCC Rcd. 2654 (1999), *recon. granted in part and denied in part*, Order on Reconsideration, FCC 99-278 (rel. Oct. 7, 1999) ("SHVA Order on Reconsideration").

[4] *See* SHVIA, Title I, Section 1008, "Rules for Satellite Carriers Retransmitting Television Broadcast Signals," to be codified at 47 U.S.C. § 339(c)(3). *See also* Section 1005 of the SHVIA, which requires: "In determining presumptively whether a person resides in an unserved household . . . a court shall rely on the Individual Location Longley-Rice model as set forth by the Federal Communications Commission in Docket No. 98-201, as that model may be

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variations. EchoStar supports these proposals and does not object to the clutter loss values proposed by the Commission for the Land Use Land Cover ("LULC") variables found in the United States Department of the Interior Geological Survey ("USGS") database based on work performed by Thomas N. Rubinstein.[5]

At the same time, these proposals do not include several variables that are highly relevant to predicting the effects of land use and land cover variations and that can have a significant effect on signal intensity. These include losses associated with variables such as building height and spacing in a particular area, losses in the numerous cases where there is no Fresnel clearance, aberrations in signal reception due to multipath factors (ghosting), and other propagational anomalies.[6]

Both these and other variables can be accommodated by the predictive model required to be developed by the Commission for the purpose of determining presumptively whether a subscriber is eligible to receive distant network retransmissions by satellite. EchoStar has retained the respected engineering firm of Hammett and Edison, which has commenced a study aimed at assigning loss values to these additional variables. EchoStar expects that the first

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amended by the Commission over time under section 339(c)(3) of the Communications Act of 1934 to increase the accuracy of that model."

[5] *See* Thomas N. Rubinstein, "Clutter Losses and Environmental Noise Characteristics Associated with Various LULC Categories," IEEE Transactions on Broadcasting, Vol. 44, No. 3, September 1998 ("Rubinstein Paper").

[6] The Commission has specifically asked, with regard to the ILLR table of clutter loss in the Rubinstein paper, "whether other data are available that would allow us to expand the application of cluster loss considerations, and whether there are other approaches that are scientifically supported and could be integrated into the ILLR model to take into account losses due to vegetation and man-made structures." NPRM at ¶11.

results of this study will be available in the late spring of 2000. Particularly with respect to ghosting, a problem long recognized by the Commission, EchoStar believes it may be possible to integrate impairment measurements into the ILLR model by, ***first***, establishing an equivalence between ghosting impairment and signal strength loss and, ***second,*** associating ghosting impairment with a refined set of land use/land cover variables. The attached engineering statement prepared by Hammett and Edison puts forward a concrete proposal regarding the first step. EchoStar's engineers are also intensively pursuing the further study and field measurements required for the second step.

The NPRM also asks how it should fulfill its statutory responsibility of designating an independent and neutral entity to conduct tests at a consumer's request if a broadcaster refuses to grant the waiver contemplated by the SHVIA. NPRM at ¶ 15. EchoStar believes that, instead of identifying a specific entity or entities as designated testers, the Commission should establish criteria for qualifying testers who would conduct measurements following denial of a subscriber's waiver request by the local network station. Moreover, the Commission should rule that the same qualification criteria apply to testing conducted, at the satellite carrier's discretion, to determine in the first place whether a household is eligible for a distant signal retransmission. While the statute *prescribes* mandatory testing at the subscriber's request, it cannot be read as *precluding* testing at the satellite carrier's discretion to determine at the outset the eligibility of a household under the distant signal compulsory license of 17 U.S.C. § 119.

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Congress has instructed the Commission to rely on the Individual Location Longley-Rice ("ILLR") model that the Commission developed in Docket No. 98-201,[3] and also to ensure that the model take into account terrain, building structures, and other land cover variations.[4] The NPRM contains specific proposals intended to account for some such variations. EchoStar supports these proposals and does not object to the clutter loss values proposed by the Commission for the Land Use Land Cover ("LULC") variables found in the United States Department of the Interior Geological Survey ("USGS") database based on work performed by Thomas N. Rubinstein.[5] At the same time, these proposals do not include several variables that are highly relevant to predicting the effects of land use and land cover variations and that can have a significant effect on signal intensity.

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set forth in SHVIA. The signal intensity for determining eligibility is the Grade B standard set forth in 47 C.F.R. §73.683(a).

[3] *See Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act Part 73 Definition and Measurement of Signals of Grade B Intensity*, Report and Order ("SHVA Report and Order"), CS Docket No. 98-201, 14 FCC Rcd. 2654 (1999), *recon. granted in part and denied in part*, Order on Reconsideration, FCC 99-278 (rel. Oct. 7, 1999) ("SHVA Order on Reconsideration").

[4] *See* SHVIA, Title I, Section 1008, "Rules for Satellite Carriers Retransmitting Television Broadcast Signals," to be codified at 47 U.S.C. § 339(c)(3). *See also* Section 1005 of the SHVIA, which requires: "In determining presumptively whether a person resides in an unserved household . . . a court shall rely on the Individual Location Longley-Rice model as set forth by the Federal Communications Commission in Docket No. 98-201, as that model may be amended by the Commission over time under section 339(c)(3) of the Communications Act of 1934 to increase the accuracy of that model."

[5] *See* Thomas N. Rubinstein, "Clutter Losses and Environmental Noise Characteristics Associated with Various LULC Categories," IEEE Transactions on Broadcasting, Vol. 44, No. 3, September 1998 ("Rubinstein Paper").

I. THE PREDICTIVE MODEL MUST TAKE ACCOUNT OF ADDITIONAL FACTORS, INCLUDING GHOSTING

EchoStar supports the Commission's endeavor to refine the ILLR model by including USGS variables and assigning clutter loss values to them. EchoStar further agrees with the values proposed by the Commission for certain variables based on work performed by Thomas N. Rubinstein.[6] The problem is that these variables are under-inclusive and account only for a small portion of the impairments due to land use and land cover variations. EchoStar urges the Commission to incorporate into the ILLR model the clutter loss values associated with these additional categories of factors, including: USGS LULC variables where there is no Fresnel clearance (since the condition of clearance proposed by the Commission would improperly ignore the losses experienced by very large numbers of households); additional, more refined, land use/land cover variables; and impairments due to ghosting, which may themselves be capable of correlation to land use or cover variations.

A. The Commission Should Include Additional Land Use/Cover Variables and Remove the Fresnel Clearance Condition

While the USGS variables identified by the Commission do not include in any direct manner building height and spacing, it is well known that RF path loss at VHF and UHF frequencies is a highly correlated function of building height in the area of the receive antenna. It has also been established that the packing density of the buildings can affect path loss, and that

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[6] *See* Thomas N. Rubinstein, "Clutter Losses and Environmental Noise Characteristics Associated with Various LULC Categories," IEEE Transactions on Broadcasting, Vol. 44, No. 3, September 1998 ("Rubinstein Paper").

even path loss over rows of low buildings (typical of many residential areas) is dependent upon both building spacing and height.

The Commission should allow use of these factors in addition to the USGS LULC-based clutter loss categories. In the current NPRM, the Commission indicates that "it is reasonable to assign values [to LULC classifications for use in the ILLR table of clutter losses] only in situations for which measurement data have been analyzed and published, or for which we have some confidence in deriving such values."[7] EchoStar is currently engaged in studies that will derive clutter loss values with reasonable confidence levels for these additional variables.

The Commission also notes that "the Rubinstein values of clutter loss are derived exclusively from measurements made at receiver sites with Fresnel clearance" and proposes not to apply those values when less than 0.6 clearance exists to the first Fresnel zone.[8] In many areas of the United States, however, a likely majority of viewers are located in areas not having Fresnel clearance. Accordingly, the Fresnel clearance condition would effectively exclude all losses due to LULC factors experienced by a large number, and likely a majority, of households.[9] EchoStar has, again, undertaken measurements of losses for paths where there is no Fresnel

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[7] NPRM at ¶10. The Commission has specifically asked, with regard to the ILLR table of clutter loss in the Rubinstein paper, "whether other data are available that would allow us to expand the application of cluster loss considerations, and whether there are other approaches that are scientifically supported and could be integrate into the ILLR model to take into account losses due to vegetation and man-made structures." NPRM at ¶11.

[8] *Id.*

[9] *See* the attached technical statement.

clearance, and will report the results of these measurements to the Commission. Until such measurements become available it would be reasonable for the Commission to use the proposed clutter loss values for paths without Fresnel clearance as well.

B. Multi-Path Related Impairments Should Be Integrated in the Predictive Model

It is important to recognize that, where the statute specifically requires the Commission to take into account land use/cover variations, it does not preclude the Commission from implementing additional improvements to its model. Indeed, correctly read, the statute requires *all* improvements to the model's reliability.[10] In that respect, the Commission has repeatedly recognized that "ghosting is a problem that affects television pictures...."[11] The Commission has further acknowledged that "the Grade B standard incorporated by Congress into the SHVA implicitly includes within the definition a signal that is, in fact, viewable and not one so impaired by interference as to be degraded below the 'acceptable to the median' observer level,"[12] and that "such problems can be identified by qualified engineering personnel through actual observations...."[13] On the other hand, the Commission has also noted that ghosting is "very difficult to measure objectively," and that a specific proposal for incorporating these

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[10] *See* Section 1008 of the SHVIA, calling for a model "reliably" determining eligibility.

[11] SHVA Order on Reconsideration at ¶12 (citing SHVA Report and Order at n.101 and p. 95).

[12] SHVA Report and Order at ¶44.

[13] *Id.*

factors into the standard remains lacking. EchoStar recognizes the difficulty of integrating a phenomenon that is not measured in terms of signal strength into a model predicting signal intensity, but believes that this difficulty is not insurmountable.[14] Indeed, EchoStar has developed a methodology that may allow achieving the desired integration based on some simple principles.

First, it is possible to establish a correspondence between ghosting impairment and signal intensity loss based on the effect each has on reception quality. This work has been largely undertaken already, and EchoStar sets forth an equivalence rule based on ITU-R measurements in the attached technical statement. Specifically, the attached analysis demonstrates that it is possible to objectively measure ghosting impairment from measurement or calculation of the amplitude and time delay of a ghost image, and that these data can be correlated to the same scale of quality degradation to which losses of signal strength are also correlated.

Second, ghosting impairment measurements (or, more precisely, their strength loss equivalent) must in turn be correlated to land use/land cover variables. This correlation will then allow the Commission to integrate into the predictive model the ghosting impairment (measured in terms of its signal intensity equivalent) predicted for defined land use/cover variations. This second step requires complex work and statistically valid sets of field measurements. EchoStar has embarked on this project as well and expects results to be available in the next few months. There should be no question that the Commission should take the results of this work into account when they become available, based on its statutory obligation to take

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[14] *SHVA Order on Reconsideration* at ¶ 112.

account of "terrain, building structures and other land cover variations."[15] EchoStar notes in that regard that the Commission recognizes its statutory obligation to keep the current proceeding open so that the forthcoming studies can be included in this proceeding and, therefore, addressed more efficiently.

II. THE COMMISSION SHOULD ESTABLISH QUALIFICATION CRITERIA FOR DESIGNATED TESTERS

Under Section 1008 of the SHVIA, to be codified in pertinent part as 47 U.S.C. §339(c), a subscriber who is denied the retransmission of a signal of a distant network station may request a waiver by submitting a request through the subscriber's satellite carrier to the local network station. If the broadcaster denies the request, the statute provides for measurement in accordance with 47 C.F.R. § 73.686(d) by a qualified and independent person at the subscriber's request, subject to a "loser pays" requirement. The statute also provides that, if the network station and satellite provider are unable to agree on the person to conduct the test, the person will be designated by an independent and neutral entity designated on the basis of Commission rules. Consistent with that requirement, the Commission seeks comment on how to identify qualified entities as candidates for this procedure. *See* NPRM at ¶ 15.

Instead of designating a single entity or group of entities, the Commission should endorse a set of qualification criteria and provide that the tests may only be undertaken by entities demonstrably satisfying these criteria. EchoStar is working with the Satellite

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[15] Section 1008 of the SHVIA.

Broadcasting and Communications Association ("SBCA") to develop a proposed list of criteria for the Commission's consideration.

Additionally, the Commission should take steps to enhance the efficiency and objectivity of tests conducted *prior* to the waiver stage of the technical contest over eligibility. Indeed, in order to provide network retransmission service to a subscriber, the satellite provider must, *ab initio*, assess eligibility using the signal intensity standard in effect under 17 U.S.C. §119(d)(10)(A). To make that assessment in situations in which the predictive model predicts a household is served but, in fact, reception is limited or affected by local propagation anomalies or marginal paths, the satellite provider effectively has two options: ***first,*** it may choose to deny service based on the prediction of the model, and wait for the waiver process to play out before any signal measurements are conducted at the subscriber's request, subject to the loser-pays rule. Second, it may conduct a test to assess eligibility at that stage. In the event this early test demonstrates that the subscriber is eligible to receive satellite retransmissions of network signals, the subsequent process of waiver and its inherent delay will have been mooted.[16]

Importantly, there is nothing in the statute that prohibits the satellite provider from conducting such prior tests. While the law *prescribes* a measurement if a waiver is denied subject to the "loser pays" rule, it does not *preclude* a measurement prior to the initiation of the waiver process, at the satellite provider's discretion, to determine whether a subscriber is eligible for the distant signal in the first place. Measurement is a fundamental method for determining whether the "unserved household" condition is met, and the law cannot be read as preventing the

satellite carrier from ascertaining eligibility in this fashion. By avoiding the initial denial and the waiver process, the satellite provider will have engaged in a far more efficient approach to resolving the question of a subscriber's eligibility for retransmission service.

In that respect, EchoStar can agree that testers conducting these measurements should be subject to the same qualification criteria applicable for testing after a waiver denial. Accordingly, the Commission should expressly rule that the same criteria for qualifying testers to conduct tests upon waiver denial apply also to the pre-waiver stage.

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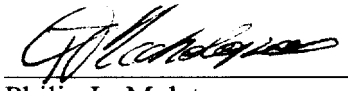
[16] If the test indicates an adequate local signal, the subscriber will be able to go forward with the waiver process, but a second test will likewise have been mooted. In that case, the first measurement would certainly be enough to satisfy the statutory requirement.

III. CONCLUSION

In conclusion, EchoStar urges the Commission to improve the ILLR predictive model by including all improvements associated with terrain, building structures and land cover variations, to keep this rulemaking open to accommodate the results of intensive studies being conducted by EchoStar, and to establish qualification criteria for designated testers.

Respectfully submitted,

By: 

David K. Moskowitz
Senior Vice President
and General Counsel
EchoStar Satellite Corporation
5701 South Santa Fe
Littleton, CO 80120
303/723-1000

Philip L. Malet
Pantelis Michalopoulos
James M. Talens
Steptoe & Johnson LLP
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036
202/429-3000

Counsel for EchoStar Satellite Corporation

Dated: February 22, 2000

Echostar Satellite Corporation

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Echostar Satellite Corporation to prepare an engineering exhibit in support of Echostar's comments to the Notice of Proposed Rulemaking in ET Docket No. 00-11.

Effects Not Considered by Existing ILLR Model

At Paragraph 13 of the NPRM, the Commission requests suggestions for revising the Individual Location Longley-Rice ("ILLR") predictive model in a timely fashion. In that respect, the Commission has previously agreed "that the Grade B standard incorporated by Congress into the SHVA implicitly includes within the definition a signal that is, in fact, viewable and not one so impaired by interference as to be degraded below the 'acceptable to the median' observer level."[1] While such impairments, including ghosting, may be readily apparent and objectionable to the viewer, and can indeed be quantified by expert observers, a usable mechanism for objectively and automatically assessing such impairments was not identified to the Commission in comments related to CS Docket 98-201, the predecessor to the instant docket.

In this statement, we propose a possible mechanism for the assessment of such ghost images and the integration of that assessment into the ILLR predictive model. This mechanism depends, first, on an "equivalence" rule between ghosting-related impairment and signal strength loss (based in turn on the correspondence of both ghosting and signal strength to the measurable level of picture quality degradation). Second, we would seek to correlate the degree of impairment to specific land use/land cover variables. We also put forward a specific data collection program to validate the proposed mechanism.

Evaluating Television Signal Impairment Due to Ghosting

When an NTSC television signal is reflected by natural or man-made terrain, the viewer receives both the original (direct or main) signal and the reflected copy, which is displaced in time. Because the reflected image looks to the viewer like it is a ghost of the main image, the phenomenon is referred to as "ghosting." The subjective effect of ghosting depends on many factors, which are physiologically and psychologically based. Viewer tests have been conducted to derive limits for amplitude of the reflected signal that can be tolerated for any particular time displacement of the ghost. If the amplitude or displacement is small, the disruption to the picture may be negligible, but it is often noticeable or objectionable. Various curves have been derived, defining the conditions

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1 See Report & Order, CS Docket No. 98-201, FCC 99-14, Released Feb. 2, para. 44.

under which ghosting would be perceptible. The most commonly used is the so-called Mertz curve,[2] shown in Exhibit A.

ITU-R Recommendation BT-654[3] suggests that the impairment characteristics shown in the top graph of Exhibit B (which is Figure 7 from the ITU-R Recommendation, corresponding to the case of a ghost that is delayed by 1 μsec from the main signal) should be used for assessment purposes. An impairment factor, D, is related to the ratio of the echo amplitude to that of the main signal, and is defined as

$$D = 20 \log \frac{S}{E}$$

where S is the main signal amplitude and E is the echo amplitude.

The impairment factor for ghosts delayed by time periods other than 1 μsec can be obtained by subtracting a correction factor obtained from the bottom graph of Exhibit B. The impairment values shown on the Y-axis of the top graph of Figure 2 are from the 5-grade scale of CCIR Recommendation 500-3.[4] This "CCIR Scale" rates the severity of the interference (ghosting or otherwise) to the picture on a scale ranging from Quality 5 "Imperceptible" to Quality 1 "Very Annoying." This mechanism provides an objective means of evaluating picture quality when ghosts are present.

Extension to Grade B Definition

Because the Grade B definition is based fundamentally upon a picture quality assessment (Equivalent to CCIR Grade 3 Picture), it is possible to compare the unimpaired picture quality rating with the rating resulting when ghosting is present. For example, it is seen from the top graph of Exhibit B that a 4 dB change in the impairment factor, D, is equivalent to a one grade change in picture quality.

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2 Pierre Mertz, "Influence of Echoes on Television Transmission," SMPTE Journal, May 1953.

3 formerly CCIR Recommendation 654, "Subjective Quality of Television Pictures in Relation to the Main Impairments of the Analogue Composite Television Signal," Recommendations and Reports of the CCIR, 1986, vol. XI, Part 1 (Dubrovnik), pp. 223–230.

4 CCIR Recommendation 500-3, "Method for the Subjective Assessment of the Quality of Television Pictures," Recommendations and Reports of the CCIR, 1986, vol. XI, Part 1 (Dubrovnik), pp. 165–173.

The planning factors[5] used to establish the Grade B median field strength include the signal-to-noise ratio required for Grade B service. Specifically, the received video carrier must be stronger than the system noise by some margin in order to provide a passable quality picture. A 45 dB "carrier-to-noise ratio" or greater is considered necessary for an excellent (CCIR Grade 5) picture, and the FCC assumed that 30 dB would suffice for a passable (CCIR Grade 3)[6] picture for the median observer in the absence of interference or other impairments. From these values, one can establish an equivalence between signal strength and degree of ghosting. That is, any perceptible amount of ghosting at the Grade B field strength (presumptively CCIR Grade 3) would cause the carrier-to-noise (C/N) ratio and hence the picture quality to fall below the passable standard used for the Grade B definition. Similarly, a signal that is 15 dB or more above the Grade B field strength (*i.e.*, presumptively CCIR Grade 5) would require 8 dB of impairment (a reduction of 2 Grades) for a 1 μsec ghost before the picture quality fell below the passable point.

Thus, for field strength levels above Grade B, the impairment factor resulting from measurement or calculation of the amplitude and time delay of a ghost image can be used to determine whether the picture is of Grade B (*i.e.*, passable) quality or not. Specifically, the equivalence principle suggested by the correlation of ghosting and signal strength loss as measures of quality is based upon ITU-R Recommendation BT-654, as described in the example above.

In-Service Measurement of Impairment due to Ghosting

Objective test methods have been designed for use by the cable television industry[7] to determine the impairment caused by "echoes." One practical method for in-service testing involves the use of the 2T pulse, which is transmitted by many NTSC television stations as part of the vertical interval test signals (VITS). These signals are routinely inserted into the video signal by television stations using test signal generators, and they are used for in-service testing of the studio and transmitter equipment. Such signals may also be used to measure the propagation

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5 Gary Kalagian, "A Review of the Technical Planning Factors for VHF Television Service," FCC/OCE Report RS 77-01, March 1, 1977. Specifically, the planning factors include ambient thermal noise, noise in the television set's own circuitry, antenna transmission line ("downlead") loss, and antenna gain. It is noted that Grade B service is such that the median field strength provides a picture which is "acceptable" to the median observer for at least 90% of the time at the best 50% of the receiving locations. In order to ensure statistical reliability that the specified signal strength would exist 90% of the time, the FCC increased required field strength by a time fading factor, yielding the median field strength values in the present Rules.

6 It is noted that the picture quality grades used in the Grade B definition are from the TASO Report, "Engineering Aspects of Television Allocations," Report of the Television Allocations Study Organization to the FCC, March 16, 1959. TASO Grade 3 is equivalent to CCIR Grade 3.

7 *E.g.*, IEC Standard 728-1, "Cabled Distribution Systems" (1986).

path.[8] Any echoes will show up as "ringing," either before or after the 2T pulse, and the amount of ringing can be measured and related to the picture impairment that it will cause.

Data Collection Proposal

In support of the use of the 2T pulse as a measurement of ghost image severity, a program of field measurement is being considered. Available prior research[9] suggests that the distribution of ghosts is continuous in both amplitude and time. It is possible, however, that generalizations can be made concerning the impairment caused by ghosting in specific classes of receiving situations (*e.g.*, LU/LC types), but additional research is required. Such a correlation, together with the correspondence between ghosting and signal strength loss established above, would allow integration of predicted ghosting values (based upon measurements) into the ILLR predictive model.

Augmentation of USGS LULC Data

At Paragraph 9 of the NPRM, the Commission proposes to classify reception point environments in terms of the codes used in the Land Use and Land Cover ("LULC") database of the U.S. Geological Survey. Because this database is the only one that covers the entire U.S., it is attractive for this purpose. It must be recognized, however, that the LULC database was not developed with radio propagation in mind and, while many of the characteristics that differentiate the categories are significant from a geophysical standpoint, they are subtle in terms of their effect on radiowave propagation. In fact, of the 37 LULC categories, just 12 have recommended clutter loss values reported by Rubinstein.[10] In Table 3 of the NPRM, the LULC categories are regrouped into just 10 (31% of 37) categories that may be differentiable from a radio propagation standpoint. Of these, several (*e.g.*, Snow and Ice and Water) have similar or identical clutter loss values. Thus, the actual number of LULC categories that are useful for defining clutter loss is relatively small.

While the proposed LULC-based clutter loss values should be preserved because of their ubiquitous geographic coverage of U.S., allowance should be made for additional categories. For example, it is well known that RF path loss at VHF and UHF is a strong function of building height

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8 Bernard Caron, "Video Channels Characterization for Advanced Television," IEEE Trans. Consumer Electronics, vol. CE-35, pp. 178-183.

9 Hufford, G.A., et al., "Characterization of the HDTV Channel in the Denver Area," NTIA Report 90-270 (1990).

10 Thomas N. Rubinstein, "Clutter Losses and Environmental Noise Characteristics Associated with Various LULC Categories," IEEE Trans. Broadcasting, vol. 44, No. 3, Sep. 1998, pp. 286–293.

in the area of the receive antenna.[11] [12] [13] It has also been established that the packing density of the buildings can affect path loss,[14] and path loss over rows of low buildings (as is typical of many residential areas) is dependent upon both building spacing and height.[15] It is therefore reasonable to assume that more extensive and more appropriate categories of land use and land cover may be developed. To the extent that these additional categories have characteristics that are demonstrably applicable to clutter loss, the FCC should allow their use in addition to the USGS LULC-based clutter loss categories.

Limitations of USGS LULC Data

Rubinstein identifies "mis-categorization" of receive locations as a potential source of error in applying the USGS LULC data, noting that "the LULC survey data in some of the areas surveyed was done as much as 20 years prior to the survey."[16] Because much more recent data is available from a variety of sources (including field surveys, satellite remote sensors, aerial photography, LIDAR, etc.), use of such more contemporary data should be permitted, when available, either to supplement or replace the USGS LULC data. Evaluation of such data, including comparison with field measurement data, is currently underway.

In addition to the "aging problem" identified by Rubinstein, some areas of particular clutter categories may not be included in the database due to its coarse resolution. According to the USGS LULC documentation,[17] the minimum area representing the man made features of the LULC polygons are 10 acres (4 hectares) that have a minimum width of 660 feet (200 meters). This minimum width precludes the existence of very narrow or long tracts of data classification. Non-urban and non-man made features may be mapped with polygons with a minimal area of 40 acres (16 hectares) that have a minimum width of 1320 feet (400 meters)." Additional mis-categorization of clutter class may therefore occur because of the limited resolution of the USGS LULC database.

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11 Kozono, S. and K. Watanabe, "Influence of environmental buildings on land mobile radio propagation," IEEE Transactions on Communications, Vol. COM-25, vol. 10, October 1977, pp. 1133-1143.

12 CCIR, "Propagation in Non-Ionized Media," XIIth Plenary Assembly, vol. II, Part 1, New Delhi, 1970, Report 239-2, p. 75

13 CCIR, "Propagation in Non-Ionized Media," XVIth Plenary Assembly, vol. V, Dubrovnik, 1986, Recommendation 270-5, pp. 247–274.

14 Akira Kinase, "Influences of Terrain Irregularities and Environmental Clutter Surroundings on the Propagation of Broadcasting Waves in the UHF and VHF Bands," NHK Technical Monograph No. 14, March 1969.

15 Henry L. Bertoni, Radio Propagation for Modern Wireless Systems, (Prentice Hall PTR, Upper Saddle River, NJ: 2000), pp. 141–179.

16 Rubinstein, *op cit.*, p. 291.

17 http://edcwww.cr.usgs.gov/glis/hyper/guide/1_250_lulc

Paragraph 11 of the NPRM notes that "the Rubinstein values of clutter loss are derived exclusively from measurements made at receiver sites with Fresnel clearance" and proposes not to apply those values when less than 0.6 clearance exists to the first Fresnel zone.[18] In many areas of the U.S., however, many – even a majority – of viewers lie in areas not having Fresnel clearance, so this limitation is not tolerable. A program of field measurements is under development to collect data on clutter loss values in certain areas not having Fresnel clearance. The use of such data should be permitted to support the use of clutter loss factors in areas not having Fresnel clearance.

List of Exhibits

In preparing this engineering statement, the following attached exhibits were prepared under my direct supervision:

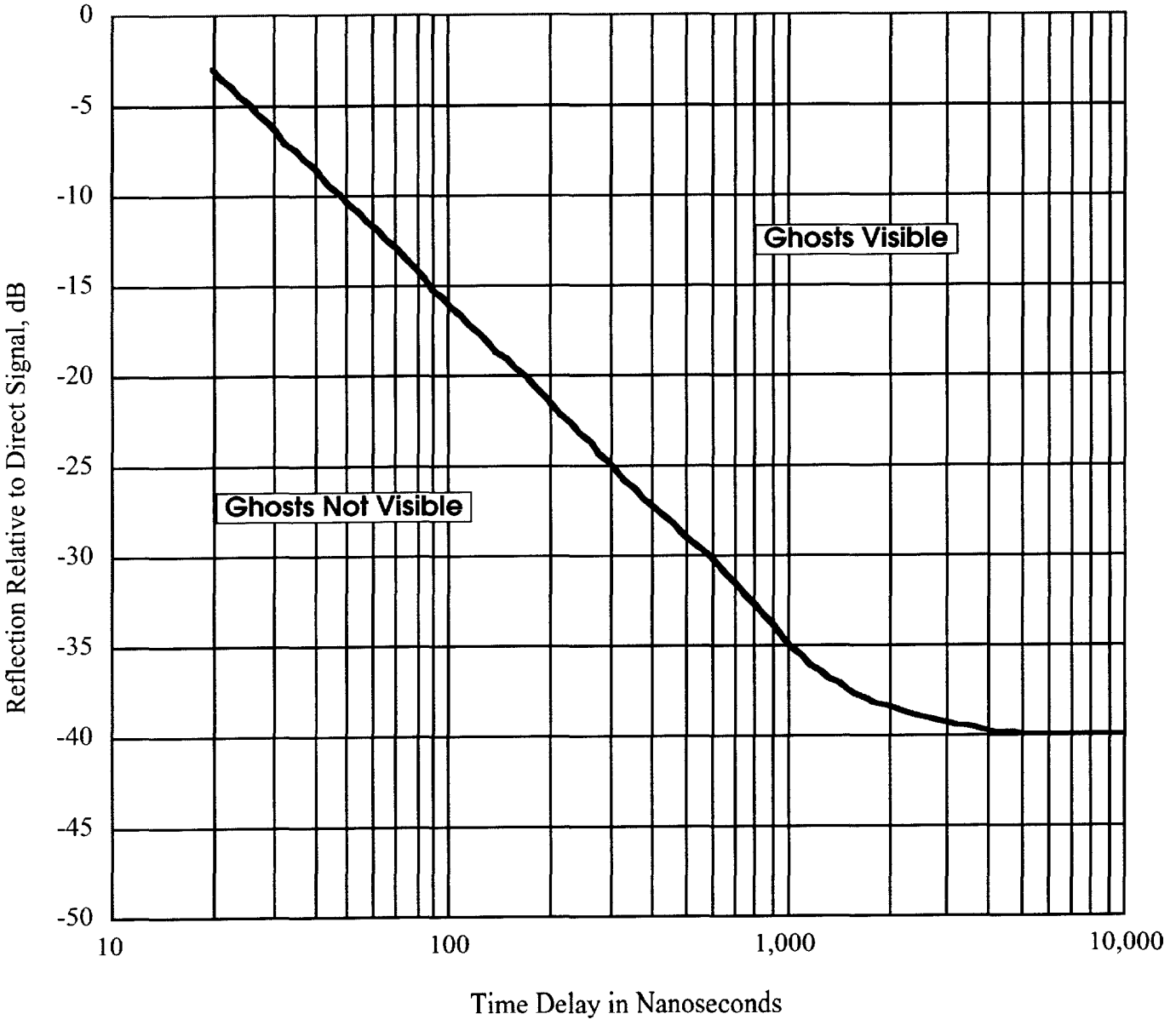
A. The Mertz Curve

B. Figures 7 and 8 from ITU-R BT-654.

[18] It appears that Rubinstein used a value of 0.778, rather than 0.6, to define a "shadowed location."

Echostar Satellite Corporation

Mertz Curve of Ghost Perceptibilty



Echostar Satellite Corporation

ITU-R Recommendation 654
Figures 7 and 8

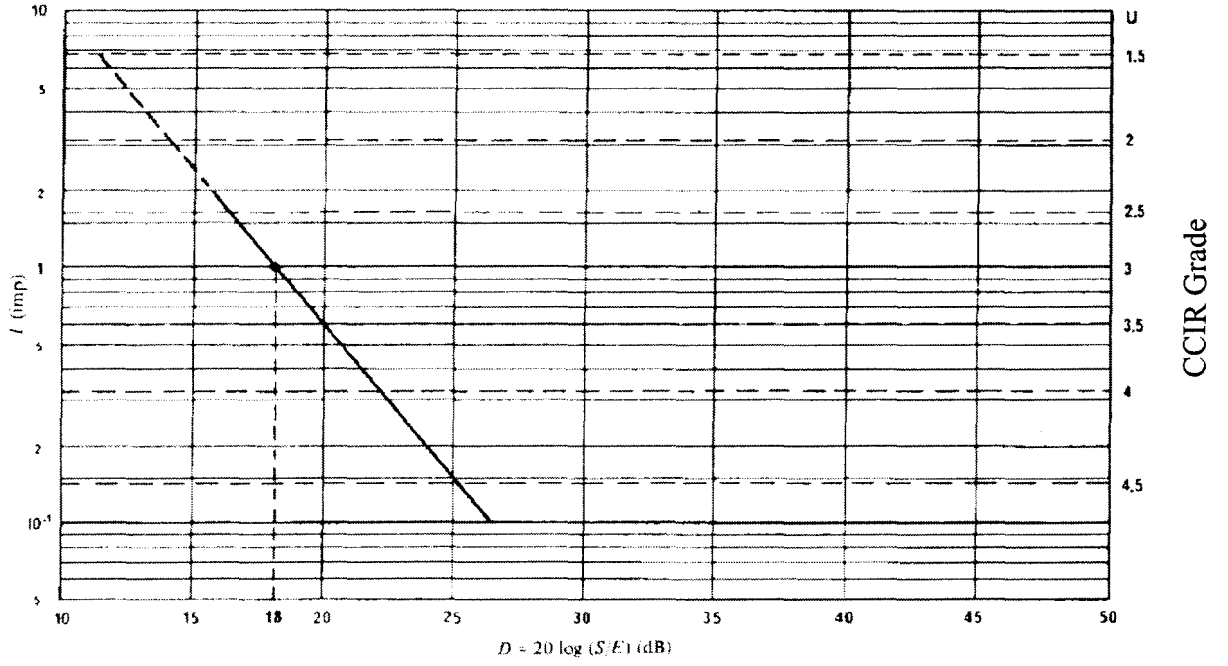


FIGURE 7 – *Impairment characteristic for an undistorted positive echo having a delay of 1 µs*

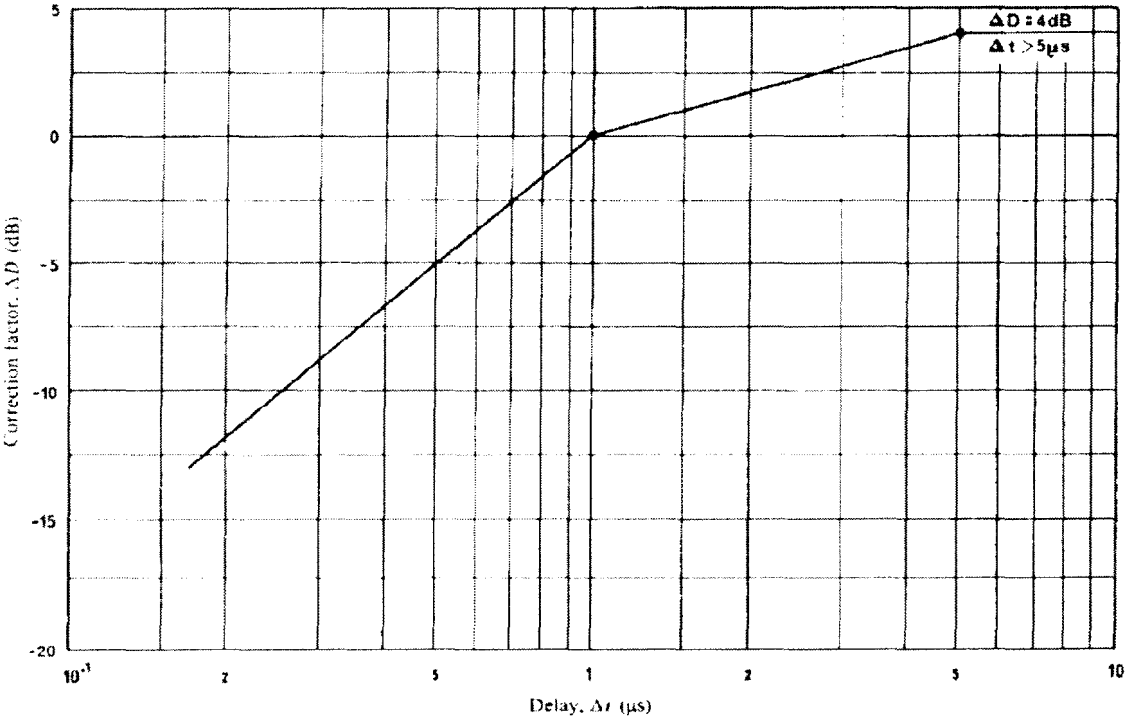


FIGURE 8 – *Correction factor to be applied to the abscissa values of D in Fig. 7 to obtain the signal/echo ratio for other values of delay*

Affidavit

State of California
County of Sonoma | ss:

Robert D. Weller, being first duly sworn upon oath, deposes and says:

1. That he is a qualified Registered Professional Engineer, holds California Registration No. E-12627 which expires September 30, 2003, and is employed by the firm of Hammett & Edison, Inc., Consulting Engineers, with offices located near the city of San Francisco, California,

2. That he graduated from The University of California, Berkeley, in 1984, with a Bachelor of Science degree in Electrical Engineering and Computer Science, was an electronics engineer with the Federal Communications Commission from 1984 to 1993, with specialization in the areas of FM and television broadcast stations, cable television systems and satellite systems, and has been associated with the firm of Hammett & Edison, Inc., since June 1993,

3. That the firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of Echostar Communications Corporation to prepare an engineering exhibit in support of its comments to the Notice of Proposed Rulemaking in ET Docket ET-00-11,

4. That he has carried out such engineering work and that the results thereof are attached hereto and form a part of this affidavit, and

5. That the foregoing statement and the report regarding the aforementioned engineering work are true and correct of his own knowledge except such statements made therein on information and belief and, as to such statements, he believes them to be true.

Robert D. Weller, P.E.

Subscribed and sworn to before me this 18th day of February, 2000

JERI L. THOMSEN
Comm. #1183920
NOTARY PUBLIC - CALIFORNIA
Sonoma County
My Comm. Expires May 29, 2002

CERTIFICATE OF SERVICE

I, Pantelis Michalopoulos, hereby declare that copies of the foregoing Comments of EchoStar Satellite Corporation were sent this 22nd day of February, 2000 by messenger to the following:

Chairman William E. Kennard
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 8B-201
Washington, D.C. 20554

Commissioner Susan Ness
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 8B-1115
Washington, D.C. 20554

Commissioner Michael K. Powell
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 8A-204
Washington, D.C. 20554

Commissioner Harold W. Furchtgott-Roth
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 8A-302
Washington, D.C. 20554

Commissioner Gloria Tristani
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 8C-302
Washington, D.C. 20554

Deborah Klein
Cable Services Bureau
Federal Communications Commission
445 Twelfth Street, S.W. – Room 3-C830
Washington, D.C. 20554

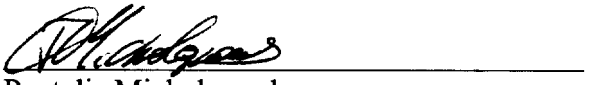
Donald Abelson, Bureau Chief
International Bureau
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 6-C723
Washington, D.C. 20554

Deborah Lathen
Chief, Cable Services Bureau
Federal Communications Commission
445 Twelfth Street, S.W. – Room 3-C830
Washington, D.C. 20554

Eloise Gore
Cable Services Bureau
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 4A726
Washington, D.C. 20554

Rosalee Chiara
International Burea
Federal Communications Commission
The Portals
445 Twelfth Street S.W. – Room 6-A521
Washington, D.C. 20554

William Johnson
Cable Services Bureau
Federal Communications Commission
The Portals
445 Twelfth Street, S.W. – Room 3-C742
Washington, D.C. 20554



Pantelis Michalopoulos